

State of Hawai'i  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
Division of Aquatic Resources  
Honolulu, Hawai'i 96813

June 8, 2007

Board of Land  
and Natural Resources  
Honolulu, Hawai'i

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National  
Monument Research Permit to Dr. Matthew Craig, University of Hawai'i, Hawai'i  
Institute of Marine Biology (HIMB) for Access to State Waters to Conduct Reef Fish  
Life History Research Activities.

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of a Papahānaumokuākea Marine National Monument Research Permit to Dr. Matthew Craig, HIMB, pursuant to § 13-60.5, *Hawai'i Administrative Rules*, and § 187A-6, *Hawai'i Revised Statutes*, and all other applicable laws and regulations. The Research Permit, described below, will allow activity to occur in the NWHI State Marine Refuge (0-3 miles) waters surrounding Nihoa Island, French Frigate Shoals, Gardner Pinnacles, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, and Kure Atoll. The activities will occur from July 7, 2007 through July 31, 2007, and August 13, 2007 through September 10, 2007 as outlined below and in the attached permit application.

INTENDED ACTIVITIES

The purpose of the applicant's research is to compile life history data for a suite of reef fishes within the Monument to determine 1) the relationship between age and growth, 2) the age/size at first sexual maturity, and 3) the relationships among morphological measurements commonly used in fisheries science (e.g., standard length to total length, length to weight). The applicant proposes to study species already being sampled for genetic analysis by B. Bowen and colleagues. The applicant also proposes to examine two reef species not under study by Bowen and colleagues, but that have been identified as important species both from an ecological standpoint and to the fishing preference of many residents of the state of Hawaii (red weke, *Mulloidichthys vanicolensis*, awo'o'weo, *Priacanthus meeki*). These additional species represent two commonly taken reef species in Hawaii, and represent the meso-carnivorous trophic level that is not well represented by the targets of B. Bowen and colleagues. This synergistic approach will allow for maximal use of specimens that unavoidably must be sacrificed.

## PROCEDURES

**Field Collections:** In the field, SCUBA divers equipped with spear poles will target species along the reef. A “blue water” rule will be enacted meaning that if one cannot see water behind the target specimen no shot will be taken. This greatly reduces accidental reef strikes. Specimens will be returned to the ship for processing.

**Data acquisition:** Aboard the NOAA ship Hi‘ialakai, samples will be processed according the following procedure. All specimens will immediately be sampled for genetic analysis according to established protocols (briefly, a fin clip will be taken and preserved in DMSO/NaCl buffer). Most specimens will then be bagged, labeled, and frozen for laboratory analysis. For a subset of the species, gonads will be removed aboard the ship, weighed to the nearest gram, and preserved in a 10% buffered formalin solution for later histological examination of their microstructure. Individuals will then be labeled, bagged, frozen and returned to the lab for further processing.

In the laboratory, specimens will be measured to nearest millimeter (both total and standard length), weighed to the nearest gram, and sagittal otoliths (ear “bones” used to age fishes) will be removed following standard methods. Otoliths will be stored dry for later use. Gonads will be visually inspected to determine the sex of the fish, and if in suitable condition will be removed and preserved in 10% formalin for later use in histological preparations.

## REVIEW PROCESS:

The permit application was sent out for review and comment to the following scientific entities: Division of Aquatic Resources staff, Papahānaumokuākea Marine National Monument, NOAA Pacific Islands Regional Office (NOAA-PIRO), and United States Fish and Wildlife Service. The Office of Hawaiian Affairs (OHA), and the Kaho‘olawe Island Reserve Commission (KIRC) were also consulted.

Comments received from the scientific community and the applicants written responses are summarized as follows (please note that questions regarding activities at Midway Atoll are outside the State of Hawai‘i’s jurisdiction; however they are included because they pertain to the environment of the NWHI):

### **Scientific Reviewer’s Concerns** (Concerns in quotes, applicant’s response follow):

“I would be hesitant to approve take of fish without knowing population sizes at Midway Atoll NWR, especially with climate change potentially causing decreases in fish populations.

*The lack of quantitative data on fish population densities and abundances is indeed a major gap in our understanding of the NWHI. This is not a problem that is unique to Midway Atoll, and several research groups are currently working towards establishing*

*quantitative values for these measures throughout the archipelago. While climate change may certainly be a threat to all marine organisms in the next 100-1000 years, there are surely more pressing issues that we can address on time scales relative to a human lifetime (e.g., pollution, overfishing, etc.). A key point that must be remembered is that the limited numbers of fishes that we wish to sample are being utilized by two projects, thus making full and efficient use of each sample and by all estimates will not adversely effect the population.*

“Fork (lateral-line) lengths be taken for existing species regulated by State regulation and other possible targeted, edible species that may be regulated in the future”

*While fork length is used in some regulations it should be noted that fork length is a morphometric measurement that was developed for fishes such as tunas and mackerel (Scombridae; which we are not sampling) whose vertebral column extends through to the end of the caudal notch. This renders fork length a “bone to bone” measurement. “Bone to bone” measures are the preferred morphometric measures as when a fish is preserved/frozen, shrinkage in soft tissues is not a factor. Standard length is the universal measurement taken by ichthyologists (tip of snout to end of caudal peduncle, i.e., end of vertebral column) as it is “bone to bone.” Nevertheless, we can take fork length of any fishes that may be regulated in the future.*

“Is there any Ciguatera research being conducted?”

*Ciguatera research is beyond the scope of this study. There are a number of researchers at UH Hilo who are actively working on Ciguatera and effects on reef fishes. If possible and requested by these researchers, we may be able to provide appropriate tissues for these researchers.*

“I would highly recommend that results from these studies be presented to community meetings and fishing clubs. Scientific research must take the initiative in presenting and defending their results. (Researcher should be required to present papers to the general public and just other scientists in academic settings.)”

*This is a worthwhile suggestion that I would be happy to undertake.*

“Application states that determining age structure will provide information necessary for setting appropriate size limits for fisheries species. It is unclear how sampling in an unfished/cooler water regime will relate to age/growth in heavily fished MHI populations.”

*It is stated in section 6, third paragraph, that the results from the NWHI sampling will be combined with data being collected in the MHI. It is of the utmost importance to compare fished and un-fished populations to gauge the impact that harvesting has had on populations. It is well known that life history parameters can be significantly altered by overharvest (if you take all the fish that reach maturity at 200mm, all you will have left are the few that reach maturity at 190mm; they will reproduce and slowly the population*

*parameter for age at maturity is depressed). Without an un-fished population to serve as a baseline, our ability to estimate these parameters and apply them to management is necessarily reduced. While it is true that the northernmost islands have a cooler absolute temperature at certain times of the year, it must also be remembered that there is not a "line in the sand" that demarcates the NWHI and the MHI. The lower limit of the water temperature gradually warms south across a cline. These factors will be examined to determine if there is a statistically significant effect of this change in water temperature.*

"No information provided to indicate that in late June fish will be in a reproductive condition so as to be able to determine age/size at sexual maturity."

*It is well known in reef fish biology that visual interpretation of sex is the least reliable method, most especially when fishes are not in a reproductively active state. That is why in Section 8, paragraph 1, we indicate that a subset of gonads will be preserved in 10% buffered formalin for histological analysis. This analysis does not require that gonads are in a reproductively active state to determine sex.*

"At least as ecologically important, if not more so, than addressing loss of potential reproductive output by harvesting fish before they reach reproductive age is the relationship between size and reproductive output. This aspect is not addressed in the proposal and should be incorporated."

*One cannot achieve the goals stated in our proposal without determining the parameter mentioned above. In an effort to not list tedious and obvious steps in the process, this detail was not included in the proposal. We will, of course, make efforts to estimate fecundity.*

"(The applicant) indicates that there will be collaborative sharing of samples with Bowen project however there is no mention of doing so in Bowen proposal."

*This is an obvious oversight and has been discussed with both permit applicants and monument staff.*

"On pg 23 of proposal mention is made to Appendix A in Bowen proposal which lists species and sample sizes requested by Bowen which presumably will be shared with this project. However in Bowen proposal it is stated that the sample sizes reflect collections already made at the various locations. If this is the case cannot the previously collected specimens be used in this project?"

*We have already worked up over 400 specimens collected on the last cruise. For an accurate depiction of life history parameters sample sizes typically number in the 100's per species. Future sampling will enhance previous collections. Again, we are trying to make the best use out of the specimens sacrificed for the genetics work.*

“Without a MHI component the proposed project is of limited relevance to overall management concerns as stated. Approval of this project should be contingent upon undertaking a similar, clearly defined effort in the MHI.”

*As above, section 6, third paragraph explicitly states that the results from the NWHI will be combined with data being collected in the MHI.*

One additional reviewer requested that if any Hawaiian monk seals are present in the area, all research activity should cease until the seal departs the area.

**Comments received from the Native Hawaiian community are summarized as follows:**

OHA reiterated its request that each research vessel have at least one cultural practitioner on board. Additionally, all future Papahānaumokuākea Marine National Monument permit applications should address impacts to cultural resources.

DAR STAFF RESPONSE:

A meeting was held between HIMB researchers and administrators, and DAR staff, to discuss reviewer's (Scientific, Policy, and Cultural) concerns. The applicant's responses (above) are an outcome of this meeting. The concerns raised by OHA were also discussed at the meeting. It was the consensus of those in attendance, that in order to address the requests from OHA, more information is required from OHA. Specifically, a list of acknowledged cultural practitioners who are available to accompany specific research cruises should be provided by OHA; additionally, a briefing for science researchers should be provided by OHA or a designate, to provide the information needed by individual applicants in order to address OHA's request for cultural impact analysis.

Additionally, the applicant has agreed to cease research operations if monk seals are present in the immediate vicinity.

IMPACT ANALYSIS

Although some disturbances to Monument resources may be necessary to achieve the objective of this project, the overall impact of the research should have minimal impact on Monument resources. The applicant's synergistic approach will allow for maximal use of collected specimens. The unique positioning of the world's largest marine protected area immediately adjacent to one of the most impacted coral reef ecosystems in the United States provides an opportunity to assess impacts on many communities without inherent biases due to geographical separation. Therefore, the value of this research far outweighs the minimal effects of the research activities.

FINAL STAFF RECOMMENDATIONS:

DAR staff is of the opinion that Applicant has properly demonstrated valid justifications for his application and should be allowed to enter the NWHI State waters and to conduct the activities therein as specified in the application with the following special instructions and conditions, which are in addition to the Papahānaumokuākea Marine National Monument Research Permit General Conditions:

1. Require Applicant to inform and consult with DAR regarding Applicant's cruise plan before each trip to the NWHI.
2. Species lists, by-catch, and mortality information must be reported in the post-cruise report.
3. Research operations must cease if monk seals are present in the immediate vicinity
4. No fishing is allowed in State Marine Refuge waters except as authorized under State law for subsistence, traditional and customary practices by Native Hawaiians.
5. To prevent introduction of disease or the unintended transport of live organisms, the permittee must comply with the disease and transport protocol attached to this permit.
6. Tender and dive vessels operating within the Monument are encouraged to operate at slow speed and with a bow lookout in shallow water coral reef areas in order to minimize prop or bow damage to three dimensional coral reef habitat or endangered monk seals or sea turtles.
7. Tenders and small vessels must be equipped with engines that meet EPA emissions requirements.
8. Refueling of tenders and all small vessels must be done at the NOAA ship Hi'ialakai and outside the confines of the lagoons or near-shore waters.
9. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized research activity, including work involving a bioassay or bioprospecting, must be for non-commercial purposes, i.e., not involving the use or sale of any organisms, byproducts, or material collected within the Monument for obtaining patents or intellectual property rights for profit.
10. The permittee may not convey, transfer, or distribute, in any fashion (including, but not limited to, selling, trading, giving, or loaning) any coral, live rock, or

organism collected under this permit without the express written permission of the Co-Trustees.

RECOMMENDATION:

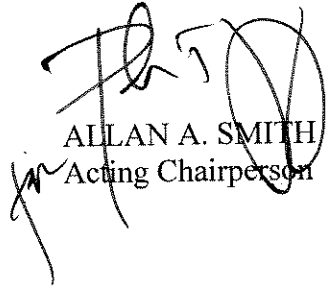
“That the Board authorize and approve, with stated conditions, a Research Permit to Dr. Matthew Craig.”

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Dan Polhemus', written in a cursive style.

DAN POLHEMUS  
Administrator

APPROVED FOR SUBMITTAL

A handwritten signature in black ink, appearing to read 'Allan A. Smith', written in a cursive style. Below the signature is the printed name and title.

ALLAN A. SMITH  
Acting Chairperson



Department of Land and Natural Resources  
Northwestern Hawaiian Islands Permit Application Review

**Permit Type:** Management ☐ Recreation ☐ Research ☒  
Education ☐ Cultural ☐ Special Ocean Use ☐

**Working Title:** Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to Dr. Matthew Craig, University of Hawai'i, Hawai'i Institute of Marine Biology (HIMB) for Access to State Waters to Conduct Reef Fish Life History Research Activities.

**Project Applicant:** Dr. Matthew Craig, HIMB

**Project Location(s) (Both State Waters and Monument):** Nihoa Island, French Frigate Shoals, Gardner Pinnacles, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, and Kure Atoll

**Project Dates and Duration:** July 7, 2007 through July 31, 2007, and August 13, 2007 through September 10, 2007

**Project Précis & Background** *(Summary of project and why this is proposed):*

The purpose of the applicant's research is to compile life history data for a suite of reef fishes within the Monument to determine 1) the relationship between age and growth, 2) the age/size at first sexual maturity, and 3) the relationships among morphological measurements commonly used in fisheries science (e.g., standard length to total length, length to weight).

**Are there other relevant permits that have/will be issued with regard to this project?** No ☒

**What is the relevance to management and/or the improved understanding of NWHI & MHI?**

The effective management of marine protected areas requires detailed information regarding life history biometrics of managed species. The unique positioning of the world's largest marine protected area immediately adjacent to one of the most impacted coral reef ecosystems in the United States provides an opportunity to compare changes in life history parameters without inherent biases due to geographical separation.

**Could work be conducted outside the NWHI?:** Yes ☐ No ☒

**Has Applicant been granted a permit from the State in the past?** No ☒  
**If so, please summarize past permits:**

**Recommendations:**

**DAR Staff:** Approve this permit application ☒ Reject this permit application ☐  
**NH CWG:** Approve this permit application ☐ Reject this permit application ☐

**Additional Comments:**



**Northwestern Hawaiian Islands Marine National Monument**  
Permit Application

**NOTE: This Permit Application (and associated Instructions) are for activities to be conducted in the Northwestern Hawaiian Islands Marine National Monument, including Hawaiian Islands National Wildlife Refuge, the Midway Atoll National Wildlife Refuge, Battle of Midway National Memorial, Northwestern Hawaiian Islands State Marine Refuge, Kure Atoll Hawaii State Seabird Sanctuary, and the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, please provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historical and cultural resources of the NWHI Marine National Monument (Monument).**

**Summary Information**

Applicant name: Matthew T. Craig

Permit categories:

- ☒ Research – Please fill out Sections A-D (as applicable) and Appendix A
- ☐ Conservation and Management - Please fill out Sections A-D (as applicable) and Appendix A
- ☐ Education - Please fill out Sections A-D (as applicable) and Appendix B
- ☐ Native Hawaiian Practices - Please fill out Sections A-D (as applicable) and Appendix C
- ☐ Recreation (Midway ONLY) - Please fill out Sections A-D (as applicable) and Appendix D
- ☐ Special Ocean Use - Please fill out Sections A-D (as applicable) and Appendix E

Briefly describe permit activity:

To collect/sample reef fishes for the purpose of performing a comparative life history analysis.

- ☐ This application is for a RENEWAL of an existing permitted project.
- ☒ This application is for a NEW project.

When will the activity take place?

From: 8/1/2007 To: 8/30/2007

**NOTE: INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED**

Please Send Permit Applications to:

NWHI Marine National Monument Permit Coordinator

6600 Kalaniana'ole Hwy. # 300

Honolulu, HI 96825

[Hoku.johnson@noaa.gov](mailto:Hoku.johnson@noaa.gov)

PHONE: (808) 397-2660 FAX: (808) 397-2662

**NOTE: SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR ADDITIONAL SUBMITTAL INSTRUCTIONS, PLEASE SEE PG 7.**

## **Section A - Applicant Information**

### **1. Applicant**

Name (last, first, middle initial): **Craig, Matthew T.**

Title: Assistant Researcher

**2. Mailing address (street/P.O. box, city, state, country, zip):** P.O. 1346, Kaneohe, HI 96744

Phone: 236-7428

Fax: 236-7443

Email: mtcraig@hawaii.edu

For students, major professor's name, telephone and email address:

**3. Affiliation (institution/agency/organization directly related to the proposed project):**

Hawaii Institute of Marine Biology

**4. Additional persons to be covered by permit:**

Erik Franklin, HIMB, [erikcf@hawaii.edu](mailto:erikcf@hawaii.edu), 808-728-9356

Brian Bowen, HIMB, [bbowen@hawaii.edu](mailto:bbowen@hawaii.edu), 808-236-7426

Randy Kosaki, NOAA, [randall.kosaki@noaa.gov](mailto:randall.kosaki@noaa.gov)

Carl Meyer, HIMB, [carlm@hawaii.edu](mailto:carlm@hawaii.edu)

Student assistants to be determined

## **Section B: Project Information**

### **5a. Project location(s):**

<input type="checkbox"/> Nihoa Island	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Ocean-based
<input type="checkbox"/> Necker Island (Mokumanamana)	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Ocean-based
<input checked="" type="checkbox"/> French Frigate Shoals	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Ocean-based
<input type="checkbox"/> Gardner Pinnacles	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Ocean-based
<input type="checkbox"/> Maro Reef		
<input type="checkbox"/> Laysan Island	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Ocean-based
<input type="checkbox"/> Lisianski Island, Neva Shoal	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Ocean-based
<input checked="" type="checkbox"/> Pearl and Hermes Atoll	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Ocean-based
<input checked="" type="checkbox"/> Midway Atoll	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Ocean-based
<input checked="" type="checkbox"/> Kure Atoll	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Ocean-based
<input type="checkbox"/> Other		

NOTE: Please note there is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

Location**	Longitude	Latitude
Kure Atoll	178.19706492000	28.55825235580
	178.19623585400	28.29958375730
	178.45987884800	28.29958375730
	178.46070791400	28.55742328970
Midway Atoll	177.19638223300	28.37419969920
	177.19721129900	28.13377055310
	177.52800864100	28.13459961920
	177.52800864100	28.37419969920
Pearl and Hermes Atoll	176.08850981800	28.04643025580
	175.63289162600	28.04539944540
	175.63289162600	27.70729363750
	176.08954062900	27.70626282710
French Frigate Shoals	165.93465851400	23.94630965900
	165.93465851400	23.56421738120
	166.45685129400	23.56421738120
	166.45685129400	23.94630965900

\*\*Note that exact locations will be unknown until cruise schedule for the NOAA Ship Hi'ialakai is finalized. Exact sites at each location are chosen based on weather and sea state conditions and cannot be explicitly identified prior to cruise. The GPS coordinates given approximate a rectangle surrounding each island/atoll at the 100fa contour (in decimal degrees, projection geographic, datum WGS84).

### **5b. Check all applicable regulated activities proposed to be conducted in the Monument:**

☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving monument resource

☐ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands

☐ Anchoring a vessel

☐ Deserting a vessel aground, at anchor, or adrift

☐ Discharging or depositing any material or matter into the monument

☐ Touching coral, living or dead

☒ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the monument

☐ Attracting any living monument resource

☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)

☐ Subsistence fishing (State waters only)

☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

**6. Purpose/Need/Scope State purpose of proposed activities:**

The primary goal of this research is to compile life history data for a suite of reef fishes within the Northwestern Hawaiian Islands Marine National Monument (the Monument). We aim to determine 1) the relationship between age and growth, 2) the age/size at first sexual maturity, and 3) the relationships among morphological measurements commonly used in fisheries science (e.g., standard length to total length, length to weight). A major “value added” component is that we propose to study species already being sampled for genetic analysis by B. Bowen and colleagues. This synergistic approach will allow for maximal use of specimens that unavoidably must be sacrificed. We also propose to examine two reef species not under study by Bowen and colleagues, but that have been identified as important species both from an ecological standpoint and to the fishing preference of many residents of the state of Hawaii (red weke, *Mulloidichthys vanicolensis*, aweo’weo, *Priacanthus meeki*). These additional species represent two commonly taken reef species in Hawaii, and represent the meso-carnivorous trophic level that is not well represented by the targets of B. Bowen and colleagues.

These data are critical to effectively manage fisheries. Determining the age structure of populations is a necessary first step in 1) setting appropriate size limits for fisheries species, 2) more fully understanding the impacts of fishing pressure, and 3) developing conservation priorities to ensure the persistence of vulnerable reef species. When correlated with an estimate of age of first maturity (and by extrapolation first reproductive effort) these data become increasingly important.

In addition to the characterization of the population parameters within the Monument, our data will be critical in a comparative study of impacted versus non-impacted populations of reef fishes. The Monument provides an unprecedented setting to test the effects of human impacts on life history parameters and population structure of these characters. Through a collaborative effort with researchers at various agencies within the state of Hawaii, we aim to compare our data with similar data from the main Hawaiian Islands. This will lead to an explicit understanding of the impact that fishing pressure has on the age structure, maximum size, and relative timing of reproduction for Hawaiian reef fishes.

**7. As explained further in the instructions, please provide any information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historical and cultural resources of the Monument:**

The Monument provides an unprecedented setting to test the effects of human impacts on life history parameters of reef fishes. The unique positioning of the world’s largest marine protected area immediately adjacent to one of the most impacted coral reef ecosystems in the United States provides an opportunity to assess impacts on many communities without inherent biases due to geographical separation. The Monument therefore is an essential area to sample in order to make robust, scientifically based conclusions regarding the impact fisheries may have on the age structure and reproductive effort of many reef fish species.

This research will be conducted in a manner compatible with the management direction of the Monument and will considerably enhance Monument resources and ecological integrity. The development of management strategies that take into consideration age structure of populations and correlate those with age at first maturity will elucidate the degree to which fishing pressure in impacted areas influences these population parameters. This can be communicated in terms of potential reproductive output lost from harvesting individuals before

they reach a reproductive age. Understanding the potential reproductive output along with a measure of baseline population age structure will allow resource managers to gauge the value of the resources within the Monument boundaries by combining our data with population abundance and size frequency data generated by programs such as RAMP.

While this research does require sacrificing a limited number of individuals, it should be noted that these individuals will also be used in a synergistic manner with other research projects. Most of the species of interest are also being used for genetic analysis by B. Bowen and colleagues, and the specimens will be available for any other ongoing studies that can utilize the material, thus we are maximizing the use of each and every individual that is sacrificed within the reserve. Therefore, the benefits of this research are maximized and greatly outweigh the costs of the extremely limited harvest.

## **8. Procedures:**

**Field Collections:** In the field, our collections will rely on the same methods proposed by Bowen and colleagues for the reef fish genetics sampling. Briefly, SCUBA divers equipped with spear poles will target species along the reef. A “blue water” rule will be enacted meaning that if one cannot see water behind the target specimen no shot will be taken. This greatly reduces accidental reef strikes. Specimens will be returned to the ship for processing.

**Data acquisition:** Aboard the NOAA ship Hi’ialakai, samples will be processed according the following procedure. All specimens will immediately be sampled for genetic analysis according to the protocols of B. Bowen and colleagues (briefly, a fin clip will be taken and preserved in DMSO/NaCl buffer). Most specimens will then be bagged, labeled, and frozen for laboratory analysis. For a subset of the species, gonads will be removed aboard the ship, weight to the nearest gram, and preserved in a 10% buffered formalin solution for use in histological examination of their microstructure. Individuals will then be label, bagged, frozen and returned to the lab for further processing.

In the laboratory, specimens will be measured to nearest millimeter (both total and standard length), weighed to the nearest gram, and sagittal otoliths will be removed following the methods of Craig et al. (Bull. Mar. Sci. 65[3],1999). Otoliths will be stored dry for later use. Gonads will be visually sexed and if in suitable condition will be removed and preserved in 10% formalin for later use in histological preparations.

Following removal, otoliths will either be mounted on wooden blocks using cyanoacrylate adhesive and sectioned using a Buehler-Isomet low speed, double-diamond bladed saw or embedded in resin and ground with 100grit sand paper. These methods allow for the visualization of annuli which give a direct measure of the individual’s age.

## **Section C: Logistics**

### **9. Other permits (list and attach documentation of all other related Federal or State permits):**

**9a. For each of the permits listed, please identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Please explain the circumstances surrounding the violation or permit suspension, amendment, modification or revocation.**

**10. Funding sources (Please attach copies of your budget, specific to proposed activities under this permit and include funding sources. Please see instructions for more information):**

Detailed budget information is available upon request from the Monument Permit Coordinators, and sufficient funding exists to complete the research outlined herein. This research is currently, or has been previously, funded by a combination of the following agency sources:

- 1) NWHIMNM-HIMB partnership
- 2) Special Allocation of Funds from HIMB to MTC

**11. Time frame:**

Activity start: 8/1/2007

Activity completion: 8/30/2007

Dates actively inside the Monument:

From: TBD during interval above.

To: TBD during interval above.

Below, we provide dates based on the draft NOAA cruise schedule for 2007. We are awaiting final word from the NOAA vessel Hi'ialakai regarding the exact dates of departure and return.

Please describe any limiting factors in declaring specific dates of the proposed activity at the time of application:

Specific dates cannot be finalized until cruise schedule for NOAA ship Hi'ialakai is approved.

Personnel schedule in the Monument:

All personnel will be at the same location as dictated by the travel schedule of the NOAA ship Hi'ialakai. The tentative August 2007 cruise schedule is:

01 August 2007	Depart Honolulu 0800, transit to French Frigate Shoals (480 NM)
02 August 2007	Transit
03 August 2007	Arrive SE corner FFS, full day dive ops
04 August 2007	FFS, full day dive ops
05 August 2007	FFS, full day dive ops
06 August 2007	FFS, full day dive ops
07 August 2007	FFS, full day dive ops, depart 1830 for Pearl & Hermes (570 NM)
08 August 2007	Transit
09 August 2007	Transit
10 August 2007	Arrive Pearl & Hermes, full day dive ops
11 August 2007	P&H, full day dive ops
12 August 2007	P&H, full day dive ops

13 August 2007	P&H, full day dive ops
14 August 2007	P&H, full day dive ops, Depart 1900 for Midway (60 NM)
15 August 2007	Arrive Midway early AM, 2/3 day dive ops
16 August 2007	Midway, 2/3 day dive ops, Depart 1800 for Kure
17 August 2007	Arrive Kure early AM, full day dive ops
18 August 2007	Kure, full day dive ops
19 August 2007	Kure, full day dive ops
20 August 2007	Kure, full day dive ops, Depart 1830 for Honolulu (1200 NM)
21 August 2007	Transit
22 August 2007	Transit
23 August 2007	Transit
24 August 2007	Transit
25 August 2007	Arrive Honolulu approx. 1830

**12. Please indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument:**

All scientific personnel aboard the NOAA vessel Hi'ialakai will be covered by UH.

**13. Please check the appropriate box to indicate how personnel will enter the Monument:**

- ☒ Vessel  
☐ Aircraft

Provide Vessel and Aircraft information:

NOAA Ship Hi'ialakai

**14. What certifications/inspections do you have scheduled for your vessel? Please fill in scheduled date (attach documentation):**

- ☐ Rodent free, Date:  
☐ Tender vessel, Date:  
☐ Ballast water, Date:  
☐ Gear/equipment, Date:  
☐ Hull inspection, Date:

**15. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):**

Vessel name:

Vessel owner:

Captain's name:

IMO#:



Vessel ID#:

Flag:

Vessel type:

Call sign:

Embarkation port:

Last port vessel will have been at prior to this embarkation:

Length:

Gross tonnage:

Total ballast water capacity volume (m3):

Total number of ballast water tanks on ship:

Total fuel capacity:

Total number of fuel tanks on ship:

Marine Sanitation Device:

Type :

How will you comply with the 'No Discharge' regulations stipulated in Presidential Proclamation 8031? Describe in detail. If applicable, please attach schematics of the vessel's discharge and treatment systems:

Other fuel/hazardous materials to be carried on board and amounts:

Please provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Please provide the name and contact information of the contractor responsible for installing the VMS system. Please also describe unit name and type:

VMS Email:

Inmarsat ID#:

## **16. Tender information:**

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? Please list the number of tenders/skiffs aboard and specific types of motors:

The Hi'ialakai tender vessels include:

HI-1 (8m) in-board jetboat

HI-2 (10m) in-board jetboat

Inflatable/whaler with outboard motor

## **Section D: Additional Information for Land Based Operations**

**17. Proposed movement of personnel, gear, materials, and, if applicable, samples:**

**18. Room and board requirements on island:**

**19. Work space needs:**

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct.

---

Signature

Date

**PLEASE SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE BELOW:**

NWHI Marine National Monument Permit Coordinator  
6600 Kalaniana'ole Hwy. # 300  
Honolulu, HI 96825  
FAX: (808) 397-2662

### **DID YOU INCLUDE THESE?**

- ☐ Applicant CV/Resume/Biography
- ☐ Electronic and Hard Copy of Application with Signature
- ☐ Map(s) or GPS point(s) of Project Location(s), if applicable
- ☐ Funding Proposal(s)
- ☐ Funding and Award Documentation, if already received
- ☐ Documentation of Insurance, if already received
- ☐ Documentation of Inspections
- ☐ Documentation of all required Federal and State Permits or applications for permits
- ☐ Statement of information you wish to be kept confidential

## **Appendix A: Research OR Conservation and Management Application**

**NOTE: If land or marine archeological activities are involved, please contact the Monument Permit Coordinator at the address on the general application form before proceeding, as a customized application will be needed. For more information, please contact the Monument office on the first page of this application.**

**1a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):**

Common name:

Glasseye (aweo'weo)

Yellowfin goatfish (weke'ula)

Plus Various, see Appendix I.

Scientific name:

*Priacanthus meeki*

*Mulloidichtys vanicolensis*

Plus Various, see Appendix I.

# & size of specimens: To be determined based on sampling in June.

Collection location: All sites listed above.

☒ Whole Organism ☐ Partial Organism

**1b. What will be done with the specimens after the project has ended?** Specimens will be returned to the laboratory (HIMB) where they will be processed further.

**1c. Will the organisms be kept alive after collection?** ☐ Yes ☒ No

• Specific site/location: N/A

• Is it an open or closed system? ☐ Open ☐ Closed

• Is there an outfall? ☐ Yes ☐ No

• Will these organisms be housed with other organisms? If so, what are the other organisms?

• Will organisms be released?

**2. If applicable, how will the collected samples or specimens be transported out of the Monument?** Frozen aboard NOAA ship Hi'ialakai.

**3. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:** As stated above, the proposed research aims to utilize specimens collected by B. Bowen and colleagues for genetic analysis to their fullest extent.

**4a. Gear and materials:** SCUBA divers using spear poles.

**4b. Please list all Hazardous Materials you propose to take to and use within the Monument:**  
10% Formalin

**5. Fixed installations and instrumentation:** N/A

**6. Provide a time line for sample analysis, data analysis, write-up and publication of information:** Sample processing will primarily be accomplished throughout the duration of 2007. Data processing and final write up will likely finish in 2008.

**7. List all publications directly related to the proposed project:**

1. **Craig, M. T.** 2007. Preliminary observations on the life history of the white- streaked grouper, *Epinephelus ongus* (Serranidae), from Okinawa, Japan. **Ichthyological Research** 54(1):81-84.
2. Pondella, D. J., II, L. G. Allen, **M. T. Craig**, and B. Gintert. 2006. Evaluation of eelgrass mitigation and fishery enhancement structures in San Diego Bay, California. **Bulletin of Marine Science** 78(1):155-131.
3. **Craig, M. T.**, and D. J. Pondella, II. 2006. A survey of the fishes of the Cabrillo National Monument, San Diego, California. **California Fish and Game**. 92(4):172-183.
4. **Craig, M. T.**, F. J. Fodrie, and P. A. Hastings. 2003. The nearshore fish assemblage of the Scripps Coastal Reserve. **Coastal Management** 32:341-351.
5. Pondella, D. J., II, J. S. Stephens, Jr. and **M. T. Craig**. 2002. Fish productivity of a temperate artificial reef based upon the density of embiotocids (Teleostei: Perciformes). Proceedings of the Seventh International Conference on Artificial Reefs and Related Aquatic Habitats, October. **ICES Journal of Marine Science** 59:S88-S93.
6. **Craig, M. T.**, D. J. Pondella, II, and J. C. Hafner, 1999. Analysis of Age and Growth in two Eastern Pacific Groupers (Serranidae: Epinephelinae). **Bulletin of Marine Science** 65(3):807-814.

**DID YOU INCLUDE THESE?**

☒ Material Safety Data Sheets for Hazardous Materials

## **Curriculum Vitae**

(Updated 22 January 2007)

### **Matthew T. Craig, M.A., Ph.D.**

Assistant Researcher  
Hawaii Institute of Marine Biology  
P.O. Box 1346  
Kaneohe, HI 96744  
[mtcraig@hawaii.edu](mailto:mtcraig@hawaii.edu)

### **Education**

A.B., 1998, Biology (Emphasis in Marine Biology), Occidental College  
M.A., 2000, Biology (Emphasis in Evolutionary Biology), Occidental College  
Thesis advisor: John C Hafner  
Ph.D., 2005, Marine Biology, Scripps Institution of Oceanography  
Thesis title: Molecular systematics of the serranid subfamily Epinephelinae:  
Speciation and biogeography in a nearshore marine fish clade.  
Thesis advisor: Philip A. Hastings

### **Research Positions**

Hawaii Institute of Marine Biology  
Assistant Researcher, 2006-present

Hawaii Institute of Marine Biology  
Postdoctoral Research Fellow, 2005  
PI: Brian W. Bowen

Scripps Institution of Oceanography  
California Seagrant Trainee, 2002-2005

Vantuna Research Group, Los Angeles  
Affiliated Research Associate, 1999-present  
Graduate Research Assistant, 1998-1999  
Lab Technician/Field Assistant, 1995-1998

R/V VANTUNA, Los Angeles Harbor, California  
Crew Member/Assistant Biologist, 1995-1998

### **Grants (Pending)**

National Geographic Society

The Cocos-Keeling connection: Exploring connectivity among Indian Ocean and Pacific Ocean reef fishes. \$16,200.00

The Systematics Association

Grouping the Groupers: Speciation and Biogeography in a Marine Fish Clade, \$2000.00

National Science Foundation (Systematics Panel)

Molecular phylogenetics of the groupers: Speciation and Biogeography in marine shore fishes. \$484,481.00

### **Grants (Funded)**

U. S. Department of the Interior (National Park Service) 2004

Characterizing the fish assemblage of the Cabrillo National Monument. \$16,313.00

UCMexus Dissertation Grant, 2002-2004

"Intraspecific biodiversity in fisheries important species: Implications for Management and Conservation." \$11,597.00

PADI Foundation Marine Research Grant, 2002

"Characterizing the near-shore marine fish assemblage of the Scripps Coastal Reserve." \$4500.00

University of California Natural Reserve System Mildred E. Mathias Graduate Student Research Grant, 2000-2001.

"The marine fish assemblage of the Scripps Coastal Reserve." \$1500.00

American Museum of Natural History Lerner-Gray Fund for Marine Research, 2001

Project Title: "Phylogeny and Biogeography of the serranid fish genus *Epinephelus*." \$1500.00

American Museum of Natural History Lerner-Gray Fund for Marine Research, 1999

"Phylogenetic analysis of the New World Groupers (Serranidae; Epinephelinae)." \$1000.00

Occidental College Dean's Fellowship, 1999

"Grouping the Groupers: A cladistic approach to their molecular phylogeny." \$3000.00

Occidental College Richter Fellowship, 1997

"Age and Growth in two *Epinephelus* Congeners" and

"Observations on the Life History of the White Spotted Sandbass, *Paralabrax albomaculatus*, (Serranidae)." \$6327.00

## **Awards**

Carl Hubbs Research Fellowship, Scripps Institution of Oceanography, 2003, 2004

The Systematics Association Student Bursary Award, 2001, 2003

American Institute of Fishery Research Biologists Second Runner-up, 2002

“The nearshore marine fish assemblage of the San Diego/La Jolla ecological reserve.”  
(Presented at the 2002 annual meeting of the Southern California Academy of Sciences)

American Society of Ichthyologists and Herpetologists Edward C. and Charlotte E. Raney  
Award for excellence in ichthyological research, 2001

Neotropical Ichthyological Association Outstanding research involving Neotropical fishes  
award, 2000

“Phylogenetic relationships among the New World groupers (Serranidae; Epinephelinae).”  
(Presented at the 2000 annual meeting of the American Society of Ichthyologists and  
Herpetologists).

## **Publications – Peer Reviewed Full Papers**

7. **Craig, M. T.** and P. A. Hastings. 2007. A molecular phylogeny of the groupers of the subfamily Epinephelinae (Serranidae) with a revised classification of the Epinephelini. **Ichthyological Research** 54(1):1-17.
8. **Craig, M. T.** 2007. Preliminary observations on the life history of the white-streaked grouper, *Epinephelus ongus* (Serranidae), from Okinawa, Japan. **Ichthyological Research** 54(1):81-84.
9. Smith, W.L., and **M. T. Craig**. 2007. Widely casting the percomorph net: The importance of broad taxonomic sampling in the search for the placement of serranid and percoid fishes. **Copeia**. In Press.
10. **Craig, M. T.**, J. A. Eble, B. W. Bowen, and D. R. Robertson. 2007. High genetic connectivity across the Indian and Pacific oceans in the reef fish *Myripristis berndti* (Holocentridae). **Marine Ecology Progress Series**. In Press.
11. **Craig, M. T.**, P. Wirtz, P. Bartsch, and P. Heemstra. 2007. Redescription and validation of *Alphestes afer* (Bloch 1793) as an amphi-Atlantic grouper species. **Cybium**. In Press.
12. **Craig, M. T.** 2007. Facultative cleaning by the forcepsfish, *Forcipiger flavissimus* (Chaetodontidae). **Copeia**. In Press.
13. **Craig, M. T.** and J. E. Randall. 2007. Two new species of the Indo-Pacific clingfish genus *Discotrema* Briggs (Gobiesocidae). **Copeia**. In Review.

14. Rocha, L. A., **M. T. Craig**, and B. W. Bowen. 2007. Species, speciation, and the conservation of coral reefs. (Invited Review) **Coral Reefs**. In Review.
15. **Craig, M. T.**, P. A. Hastings, D. J. Pondella, II, D. R. Robertson, and J. R. Casián. 2006. Phylogeography of the flag cabrilla, *Epinephelus labriformis*: implications for the biogeography of the tropical eastern Pacific and the early stages of speciation in a marine fish. **Journal of Biogeography** 33(6):969-979.
16. **Craig, M.T.**, D.J. Pondella, II, and R.N. Lea. 2006. New records of the flag cabrilla, *Epinephelus labriformis* (Serranidae: Epinephelinae), from the Pacific Coast of Baja California, Mexico, and San Diego, California, USA, with notes on the distribution of other groupers in California. **California Fish and Game** 92(2):91-97.
17. **Craig, M. T.**, and D. J. Pondella, II. 2006. A survey of the fishes of the Cabrillo National Monument, San Diego, California. **California Fish and Game**. 92(4):172-183.
18. Hafner, J. C., E. Reddington, and **M. T. Craig**. 2006. Kangaroo mice (*Microdipodops megacephalus*) of the mono basin: Phylogeography of a peripheral isolate. **J. Mammology**. 87(6):1204-1217.
19. Pondella, D. J., II, L. G. Allen, **M. T. Craig**, and B. Gintert. 2006. Evaluation of eelgrass mitigation and fishery enhancement structures in San Diego Bay, California. **Bulletin of Marine Science** 78(1):155-131.
20. Rocha, L. A., D. R. Robertson, C. R. Rocha, J.L. Van Tassell, **M. T. Craig**, and B.W. Bowen. 2005. Recent invasion of the tropical Atlantic by an Indo-Pacific coral reef fish. **Molecular Ecology** 14:3921-3928.
21. **Craig, M. T.**, P. A. Hastings, and D. J. Pondella, II. 2004. Speciation in the Central American Seaway: The importance of taxon sampling in the identification of geminate species pairs. **Journal of Biogeography** 31:1085-1091
22. **Craig, M. T.**, P. A. Hastings, and D. J. Pondella, II. 2004. Notes on the systematics of the crestfish genus *Lophotus* (Lampridiformes; Lophotidae), with a new record from California. **Bulletin of the Southern California Academy of Sciences**. 103(2):57-65.
23. **Craig, M. T.**, F. J. Fodrie, and P. A. Hastings. 2003. The nearshore fish assemblage of the Scripps Coastal Reserve. **Coastal Management** 32:341-351.
24. Pondella, D.J., II, **M.T. Craig** and Jens Franck. 2003. The phylogeny of *Paralabrax* (Perciformes: Serranidae) and allied taxa inferred from 16S and 12S mitochondrial sequence data. **Molecular Phylogenetics and Evolution**, 29(1):176-184.



25. Pondella, D. J., II, J. S. Stephens, Jr. and **M. T. Craig**. 2002. Fish productivity of atemperate artificial reef based upon the density of embiotocids (Teleostei: Perciformes). Proceedings of the Seventh International Conference on Artificial Reefs and Related Aquatic Habitats, October. **ICES Journal of Marine Science** 59:S88-S93.
26. **Craig, M. T.**, D. J. Pondella, II, J. P. C. Franck, and J. C. Hafner. 2001. On the status of the serranid fish genus *Epinephelus*: Evidence for paraphyly based on 16s rDNA sequences. **Molecular Phylogenetics and Evolution** 19(1):121-130.
27. Pondella, D. J. II, and **M. T. Craig**. 2001. First record of the sabertooth blenny, *Plagiotremus azaleus*, in California with notes on its distribution along the Pacific coast of Baja California. **Bulletin of the Southern California Academy of Sciences**. 100(3):144-148.
28. **Craig, M. T.**, D. J. Pondella, II, and J. C. Hafner, 1999. Analysis of Age and Growth in two Eastern Pacific Groupers (Serranidae: Epinephelinae). **Bulletin of Marine Science** 65(3):807-814.
29. **Craig, M. T.** 1998. Age and Growth in two epinepheline serranids (Teleostei:Serranidae). **Proceedings of the National Conference on Undergraduate Research**. 4:1172-1176.
30. Pondella, D. J, II, R. Snodgrass, **M. T. Craig**, and H. S. Kim. 1998. Re-Occurrence of the three-band butterflyfish, *Chaetodon humeralis*, in the Santa Monica Bay, with notes on its distribution and abundance. **Bulletin of the Southern California Academy of Sciences** 97(3):121-124.

### **Publications - Technical Reports**

1. Pondella, D. J., II, and **M. T. Craig**. 2000. Quarterly Water Quality Monitoring Report. Chevron Products Company, El Segundo Refinery (NOTES permit No. CA000337). May. 29pp.
2. **Craig, M. T.**, D. J. Pondella, and L. G. Allen. 2000. The ecology of *Paralabrax* and allied genera from the Galápagos Islands. A report submitted to the Charles Darwin Research Station and Galápagos National Park System, Galápagos, Ecuador. Project #PC-010-97.
3. **Craig, M. T.**, and D. J. Pondella, II. 2001. Phylogenetic analysis of the new world groupers (Serranidae; Epinephelinae). A technical report submitted to the Florida Bureau of Marine Fisheries Management for activities conducted under permit #98S-244 (issued by the former Florida Department of Environmental Protection).
4. **Craig, M. T.**, and Daniel J. Pondella, II. 2005. Checklist of fishes of the Cabrillo National Monument. A report submitted to the United States National Park Service for activities conducted under USNPS Study #CABR-00222, permit #CABR-2003-SCI-0010.

## **Publications – Abstracts**

1. **Craig, M. T.**, P. A. Hastings, and P. K. Dayton. 2003. The nearshore fish assemblage of the San Diego/La Jolla Ecological Reserve. (Abstract). **Bulletin of the Southern California Academy of Sciences**. 2003 supplement.
2. Pondella, D. J., II, L. G. Allen, J. R. Cobb, **M. T. Craig**, and B. Gintert. 2003. Evaluation of eelgrass mitigation and fishery enhancement structures in San Diego Bay. (Abstract). **Bulletin of the Southern California Academy of Sciences**. S2:39.

## **Teaching Positions**

Lecturer, University of San Diego (MARS 157/427) The Marine Environment, Fall, 2003-04.  
Upper division course exploring human/ocean interactions. 10-25 students.

Adjunct Faculty, San Diego Community College District, SDCC (Biol 110), “Introduction to Oceanography”, Fall, 2002. Lower division introductory course. 45 students.

Instructor “Life in the Underwater Forest.” UCSD Extension (MARI 2002), Summer 2001, 2002, 2004. Lower division course for exceptional high school students focusing on kelp forest ecology in southern California. 25-35 students.

Teaching Assistant, Occidental College, Evolutionary Biology (Bio 279) 1998, ‘99, 2000  
Upper division, 30 students.

Teaching Assistant, Occidental College, Biological Statistics (Bio 368) 1999  
Upper division, 25 students.

Teaching Assistant, Occidental College, Summer Oceanology, 1999  
Lower division course for exceptional high school students. 25 students.

## **University and Other Service**

World Conservation Union (IUCN) Specialist Group, Groupers and Wrasses 2005-2008

Scripps Institution of Oceanography Diving Control Board, 2003-2005.

Scripps Institution of Oceanography Committee on Oceanographic Collections, 2001- 2005.

Scripps Institution of Oceanography Committee on Aquariums/Museums, 2001-2005.

Occidental College Dive Control Board, 1999-2000.

Journal reviewer for: Copeia; Estuarine, Coastal and Shelf Science; Fishery Bulletin; Genetics and Molecular Biology; Ichthyological Research; Journal of Experimental Marine Biology; Journal of Fish Biology; Journal of Heredity; Molecular Phylogenetics and Evolution; and Southern California Academy of Sciences Bulletin .

Grant reviewer for: U.S. Dept. of Commerce (NOAA, NMFS) MARFIN Program, Research Grants Council of Hong Kong.

### **Students Supported**

Laura Chartier, University of Hawaii, 2007

“Population structure of the California halibut, *Paralichthys californicus*”

Jenny Thompson, University of San Diego, 2004-5

“Age and growth in the white streaked grouper, *Epinephelus ongus*”

Theresa Compton, University of San Diego, 2004-5

“Age and growth in the white streaked grouper, *Epinephelus ongus*”

Jamie Koepsel, University of California, San Diego, 2001-2003

“Phylogenetic relationships of Zaniolepid fishes”

Irene Lee, University of California, San Diego, 2003-2004

“Molecular phylogeny of *Zaniolepis*”

### **Invited Seminars**

1. Ocean Research Institute, University of Tokyo, Japan. 2001

“The ecology and phylogeny of the serranid fish genus *Epinephelus* (Serranidae; Epinephelinae).”

2. CICESE, Ensenada, Mexico. 2004

“Systematics and Biogeography of the serranid fish genus *Epinephelus*”

3. Hawaii Institute for Marine Biology, USA. 2005

“Speciation in marine shorefishes.”

4. University of Hawaii, Department of Zoology. 2006

“All the pretty fishes: the importance of color pattern to species boundaries in the sea.”

5. Recent Advances in Conservation Genetics (HIMB). 2007

“Phylogeny and Conservation: Theory and Practice.”

### **Presentations to Professional Organizations**

Southern California Conference for Undergraduate Research 1997

“Age and growth in two *Epinephelus* congeners”

National Conference for Undergraduate Research 1998

“Age and growth in two *Epinephelus* congeners”

Southern California Academy of Sciences 1999

“Age and growth in two eastern Pacific serranids”

- |  |      |
|--|------|
| Southern California Academy of Sciences  | 2000 |
| “The first sighting and rare occurrence of three sub-tropical fishes in southern California”   |      |
| American Society of Ichthyologists and Herpetologists  | 2000 |
| “Phylogenetic relationships among the New World groupers (Serraniae: Epinephelinae).”  |      |
| The Systematics Association, London  | 2001 |
| “On the status of the serranid fish genus <i>Epinephelus</i> : Evidence for paraphyly based on 16S rDNA sequence.  |      |
| Southern California Academy of Sciences  | 2002 |
| “The near-shore fish assemblage of the San Diego/La Jolla ecological reserve.”   |      |
| -and-  |      |
| “Phylogeny and biogeography of the serranid fish genus <i>Epinephelus</i> .”   |      |
| American Society of Ichthyologists and Herpetologists  | 2002 |
| “Molecular phylogenetic relationships of the grouper genera <i>Alphestes</i> and <i>Dermatolepis</i> (Serranidae).   |      |
| American Society of Ichthyologists and Herpetologists  | 2003 |
| "Phylogeny and Biogeography of serranid fish genus <i>Epinephelus</i> "  |      |
| -and-  |      |
| "Notes on the systematics of the crestfish genus <i>Lophotus</i> "   |      |
| The Systematics Association, Dublin, Ireland   | 2003 |
| "Phylogeny and Biogeography of the serranid fish genus <i>Epinephelus</i> "  |      |
| University of California Natural Reserve System Symposium  | 2004 |
| “The nearshore fish assemblage of the Scripps Coastal Reserve”   |      |
| American Society of Ichthyologists and Herpetologists  | 2006 |
| “Phylogeography of the flag cabrilla, <i>Epinephelus labriformis</i> : implications for the biogeography of the tropical eastern Pacific and the early stages of speciation in a marine fish.” |      |
| -and-  |      |
| “A new species of the clingfish genus <i>Discotrema</i> (Gobiesocidae) from Papua New Guinea.”   |      |

### **Membership in Professional Organizations**

Southern California Academy of Sciences  
American Society of Ichthyologists and Herpetologists  
Society of Systematic Biologists  
Société Française d'Ichtyologie

### **Research Experience (Summary)**

Dr. Matthew Craig has been working in the field of marine science since 1994 when he began as a research assistant for a small consulting firm in Los Angeles, California. Since then, he has published numerous papers in scientific journals, newsletters, and magazines. His research accomplishments include leading more than a dozen international collecting expeditions to remote localities, serving aboard the NOAA ship *Hi'ialakai*, and leading research efforts to assess the status of impacted fish populations in coastal California. The major themes of his work span from developing comprehensive systematics revisions of major fish groups (particularly among the Percomorpha) to addressing conservation priorities with the use of both field surveys and recent advances in genetic techniques. Most recently Dr. Craig has been actively involved in assessing the connectivity of marine fish populations through the Northwestern Hawaiian Islands Marine National Monument.

### **Research Experience (Detail)**

PADI Master SCUBA Diver certified in 1994, 75-125 dive days per year 1994-present.

AAUS certified scientific research diver 2000-present.

Co-Principal Investigator: Phylogeography of the soldierfish, *Myripristis berndti*. 2005- 2006.

Collaborating Researcher: Connectivity of Indo-Pacific island marine fauna. (funded by NSF grant to B. Bowen). 2005-present.

Collaborating Researcher: Connectivity of the Hawaiian Island marine fauna. 2005-present.

Co-Principal Investigator: Characterizing the nearshore fish assemblage of the Cabrillo National Monument. 2003-04

Principal Investigator: Phylogeography of two Eastern Pacific groupers: Implications for management and conservation. 2002-2005

Principal Investigator: The nearshore-marine fish assemblage of the Scripps Coastal Reserve. 2002.

Project Coordinator/Lead Biologist: Characterizing the marine fish assemblage of the San Diego/La Jolla Ecological Reserve. 2002-2005.

Co-Principal Investigator: Phylogeny and biogeography of the chaenopsid tube blenny genus *Coralliozetus*. 2000-2004.

Principal Investigator: Phylogenetic relationships among the groupers, *Epinephelus* and allied genera (Perciformes; Serranidae). 2000-present.

Principal Investigator: Age and Growth in Two *Epinephelus* Congeners, Puerto Vallarta, Mexico, 1997-1999.

Principal Investigator: Observations on the Life History of the White Spotted Sandbass, *Paralabrax albomaculatus*. Galapagos Islands, 1998.

Cruise Leader: White Seabass, *Atractoscion nobilis*, Monitoring Project, Contract No.FG4336MR. California Department of Fish and Game, 1995-2004

Project Administrator/Field Coordinator: Monitoring the Ichthyofauna of King Harbor, Redondo Beach, CA and the Palos Verdes Peninsula, CA 1995-2000.

Field Biologist: Assessing the biota of Portuguese Bend, Palos Verdes, California, in order to evaluate the value of restoring a kelp bed, U.S. Army Corps of Engineers, 1995-1998.

Cruise Leader/Field Biologist for: Receiving Water Monitoring and Reporting Program No. 1603 (NPDES permit No. CA000337) Chevron U.S.A. Products Company, El Segundo Refinery, 1995-2000.

Field Research Assistant: Evaluating the sediment associated with the Portuguese Bend Landslide, U.S. Army Corps of Engineers, 1995-1997.

Project Design/Construction for: Light stimuli experiment as part of the San Onofre Nuclear Generating Station mitigation, Southern California Edison, 1995.

Field Biologist: Semi-annual surveys of the ichthyofauna of Marina del Rey for the Department of Beaches and Harbors, County of Los Angeles and Harbors Environmental Projects, University of Southern California, 1995-1997.

Field Biologist: Assessing the ichthyofauna of Ballona Creek, Marina Del Rey and the Ballona Wetland. Subcontract to San Marino Environmental as part of the Playavista Project, 1995-1996.

Field Biologist for the evaluation of fish enhancement structures, eelgrass mitigation plan for Nimitz class CVN Naval Air Station North Island, Coronado, San Diego, California, U.S. Navy, 1997-2003

Field Biologist for the Long Term Biological Monitoring of an Artificial Fishing Reef, Port of Los Angeles, 2001-2006.

**Appendix I. List of species requested by Bowen and colleagues to be sampled for life history data.**

Family Acanthuridae

Yellow tang *Zebrasoma flavescens*  
Brown surgeonfish *Acanthurus nigrofuscus*  
Blue-lined surgeonfish *Acanthurus nigroris*  
Orangecheek surgeonfish *Acanthurus olivaceus*  
Goldring bristletooth *Ctenochaetus strigosus*

Family Chaetodontidae

Oval butterflyfish *Chaetodon lunulatus*  
Milletseed butterflyfish *Chaetodon miliaris*  
Blueline butterflyfish *Chaetodon fremblii*  
Pebbled butterflyfish *Chaetodon multicinctus*

Family Labridae

Ornate wrasse *Halichoeres ornatissimus*  
Yellowtail coris *Coris gaimard*  
Slow wrasse *Coris venusta*  
Blacktail wrasse *Thalassoma ballieui*

Family Blenniidae

Scarface blenny *Cirripectes vanderbilti*  
Fangblenny *Plagiotremus goslinei*  
Fangblenny *Plagiotremus ewaensis*

Family Lutjanidae

Blueline snapper (ta'ape) *Lutjanus kasmira*

Family Mullidae

Manybar goatfish *Parupeneus multifasciatus*

# Material Safety Data Sheet

## 10% Neutral buffered formalin

ACC# 88082

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** 10% Neutral buffered formalin

**Catalog Numbers:** NC9638612, NC9638613, 023-798, 027-274, 028-866, 032-059, 032-060, 032-067, 032-069, 035-159, 037-238, 037-239, 038-528, 045-112, 23-005-155, 23-005-193, 23-005-500, 23-011-120, 23-111-114, 23-111-123, 23011112, 23023798, 23027274, 23028866, 23032059, 23032060, 23032067, 23032069, 23035159, 23037238, 23037239, 23038528, 23045111, 23045112, 23245684, 23245685, 23253998, 23286200, 23305510, 23314028, 23314029, 23314033, 23314034, 23314035, 23314036, 23314037, 23314038, 23314039, 23314040, 23316154, 23316155, 23316156, 23426796, 23426797, 23427098, 245-684, 245-685, 253-998, 286-200, 305-510, 314-025, 314-026, 314-028, 314-029, 314-030, 314-033, 314-034, 314-035, 314-038, 316-154, 316-155, 316-156, 316154, 316155, 316156, 426-796, 426-797, 427-098, 57011, 57011-16, 57011-GA, 57011A, 59001-20

**Synonyms:** None.

**Company Identification:**

Fisher Scientific  
1 Reagent Lane  
Fair Lawn, NJ 07410

**For information, call:** 201-796-7100

**Emergency Number:** 201-796-7100

**For CHEMTREC assistance, call:** 800-424-9300

**For International CHEMTREC assistance, call:** 703-527-3887

### Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
50-00-0	Formaldehyde	3.7	200-001-8
67-56-1	Methyl alcohol	1.5	200-659-6
7558-79-4	Sodium phosphate dibasic	<1.0	231-448-7
7558-80-7	Sodium phosphate monobasic	<1.0	231-449-2
7732-18-5	Deionized Water	Balance	231-791-2

### Section 3 - Hazards Identification



## EMERGENCY OVERVIEW

Appearance: colorless liquid. Flash Point: > 200 deg F.

**Warning!** Harmful if inhaled. Harmful if absorbed through the skin. Contains formaldehyde which can cause cancer. May cause severe skin irritation. May cause allergic respiratory and skin reaction. May cause respiratory tract irritation. May cause eye irritation and transient injury. May cause lung damage. May cause pulmonary edema. May cause reproductive and fetal effects.

**Target Organs:** Lungs, respiratory system, eyes, skin.

### Potential Health Effects

**Eye:** May cause severe eye irritation. May result in corneal injury.

**Skin:** May cause skin irritation. May cause severe skin irritation. Harmful if absorbed through the skin. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. In severe cases may produce blistering, scaling and cracking.

**Ingestion:** Harmful if swallowed. May cause irritation of the digestive tract. Ingestion may cause violent vomiting and diarrhea leading to collapse. May cause systemic toxicity including central nervous system depression, convulsions, coma, and possible death due to respiratory

**Inhalation:** Harmful if inhaled. May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. May cause asthmatic attacks due to allergic sensitization of the respiratory tract. May cause pulmonary edema and severe respiratory disturbances.

**Chronic:** Contains formaldehyde which can cause cancer in humans. There is sufficient evidence that formaldehyde causes nasopharyngeal cancer in humans, a rare cancer in developed countries. There is limited evidence that formaldehyde causes cancer of the nasal cavity and paranasal sinuses and strong but not sufficient evidence for leukemia.

## Section 4 - First Aid Measures

**Eyes:** Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed.

**Skin:** Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse. Destroy contaminated shoes.

**Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

**Inhalation:** Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. Use water spray to keep fire-exposed containers cool.

**Extinguishing Media:** For small fires, use water spray, dry chemical, carbon dioxide or chemical foam.

**Flash Point:** > 200e deg F (> 93.33 deg C)

**Autoignition Temperature:** Not applicable.

**Explosion Limits, Lower:**Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 2; Flammability: 1; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Clean up spills immediately, observing precautions in the Protective Equipment section. Provide ventilation. Urea based materials are available which can be used to bind the formaldehyde forming a polymer.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and wash before reuse. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Do not ingest or inhale. Use only with adequate ventilation.

**Storage:** Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. See 29CFR 1910.1048 for regulatory requirements pertaining to all occupational exposures to formaldehyde, i.e., from formaldehyde gas, its solutions, and materials that release formaldehyde.

**Exposure Limits**

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Formaldehyde	0.3 ppm Ceiling	0.016 ppm TWA 20 ppm IDLH	0.75 ppm TWA; 2 ppm STEL; 0.5 ppm Action Level (Irritant and potential cancer hazard - see 29 CFR 1910.1048)
Methyl alcohol	200 ppm TWA; 250 ppm STEL; skin - potential for cutaneous absorption	200 ppm TWA; 260 mg/m3 TWA 6000 ppm IDLH	200 ppm TWA; 260 mg/m3 TWA
Sodium phosphate dibasic	none listed	none listed	none listed
Sodium phosphate monobasic	none listed	none listed	none listed
Deionized Water	none listed	none listed	none listed

**OSHA Vacated PELs:** Formaldehyde: 3 ppm TWA (unless specified in 1910.1048) Methyl alcohol: 200 ppm TWA; 260 mg/m3 TWA Sodium phosphate dibasic: No OSHA Vacated PELs are listed for this chemical. Sodium phosphate monobasic: No OSHA Vacated PELs are listed for this chemical. Deionized Water: No OSHA Vacated PELs are listed for this chemical.

**Personal Protective Equipment**

**Eyes:** Wear chemical goggles.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

## Section 9 - Physical and Chemical Properties

**Physical State:** Liquid

**Appearance:** colorless

**Odor:** Characteristic odor.

**pH:** 7.0 +/-0.1@25C

**Vapor Pressure:** Not available.

**Vapor Density:** >1 (Air= 1)

**Evaporation Rate:** Similar to water.

**Viscosity:** Not available.

**Boiling Point:** 102 deg C

**Freezing/Melting Point:** Not available.

**Decomposition Temperature:** Not available.

**Solubility:** Completely soluble in water.

**Specific Gravity/Density:** 1.0 (Water=1)

**Molecular Formula:** Not applicable.

**Molecular Weight:** Not available.

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.  
**Conditions to Avoid:** Ignition sources, confined spaces.  
**Incompatibilities with Other Materials:** Strong oxidizing agents.  
**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.  
**Hazardous Polymerization:** Has not been reported

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 50-00-0: LP8925000

**CAS#** 67-56-1: PC1400000

**CAS#** 7558-79-4: WC4500000

**CAS#** 7558-80-7: WA1900000

**CAS#** 7732-18-5: ZC0110000

**LD50/LC50:**

**CAS#** 50-00-0:

Draize test, rabbit, eye: 750 ug/24H Severe;  
Draize test, rabbit, eye: 750 ug Severe;  
Draize test, rabbit, eye: 10 mg Severe;  
Draize test, rabbit, eye: 37% Severe;  
Draize test, rabbit, skin: 2 mg/24H Severe;  
Draize test, rabbit, skin: 50 mg/24H Moderate;  
Inhalation, mouse: LC50 = 454 mg/m<sup>3</sup>/4H;  
Inhalation, mouse: LC50 = 505 mg/m<sup>3</sup>/2H;  
Inhalation, rat: LC50 = 203 mg/m<sup>3</sup>;  
Inhalation, rat: LC50 = 578 mg/m<sup>3</sup>/2H;  
Inhalation, rat: LC50 = 250 ppm/2H;  
Oral, mouse: LD50 = 42 mg/kg;  
Oral, mouse: LD50

**CAS#** 67-56-1:

Draize test, rabbit, eye: 40 mg Moderate;  
Draize test, rabbit, eye: 100 mg/24H Moderate;  
Draize test, rabbit, skin: 20 mg/24H Moderate;  
Inhalation, rabbit: LC50 = 81000 mg/m<sup>3</sup>/14H;  
Inhalation, rat: LC50 = 64000 ppm/4H;  
Oral, mouse: LD50 = 7300 mg/kg;  
Oral, rabbit: LD50 = 14200 mg/kg;  
Oral, rat: LD50 = 5600 mg/kg;  
Skin, rabbit: LD50 = 15800 mg/kg; <BR.

**CAS#** 7558-79-4:

Draize test, rabbit, eye: 500 mg/24H Mild;  
Draize test, rabbit, skin: 500 mg/24H Mild;  
Oral, rat: LD50 = 17 gm/kg; <BR.

**CAS#** 7558-80-7:

Draize test, rabbit, eye: 150 mg Mild;

Oral, rat: LD50 = 8290 mg/kg; <BR.

CAS# 7732-18-5:

Oral, rat: LD50 = >90 mL/kg; <BR.

**Carcinogenicity:**

CAS# 50-00-0:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 1/1/88 (gas)
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen

CAS# 67-56-1: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

CAS# 7558-79-4: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

CAS# 7558-80-7: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

CAS# 7732-18-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

**Epidemiology:** In June 2004 an expert IARC group determined that there is now sufficient evidence that formaldehyde causes nasopharyngeal cancer in humans, a rare cancer in developed countries.

**Teratogenicity:** No information available.

**Reproductive Effects:** No information available.

**Neurotoxicity:** No information available.

**Mutagenicity:** No information available.

**Other Studies:** No data available.

## Section 12 - Ecological Information

**Ecotoxicity:** No data available. No information available.

**Environmental:** Persistence/Degradation: Substance is biodegradable in aerobic and anaerobic conditions. Bioconcentration: Studies on various fish have shown little potential for bioconcentration of substance. Soil Adsorption: log octanol/water partition coefficient=0.35 (indicates low potential for soil adsorption). Substance has a high biological oxygen demand.

**Physical:** Substance photolyzes and reacts with hydroxyl radicals. The half-life (in sunlight) is a few hours. Without light, substance reacts with nitrate radicals.

**Other:** No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:**

CAS# 50-00-0: waste number U122.

CAS# 67-56-1: waste number U154 (Ignitable waste).

## Section 14 - Transport Information

	US DOT	Canada TDG
<b>Shipping Name:</b>	AVIATION REGULATED LIQUID, N.O.S. (10% FORMALIN)	No information available.
<b>Hazard Class:</b>	9	
<b>UN Number:</b>	UN3334	
<b>Packing Group:</b>		

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 50-00-0 is listed on the TSCA inventory.

CAS# 67-56-1 is listed on the TSCA inventory.

CAS# 7558-79-4 is listed on the TSCA inventory.

CAS# 7558-80-7 is listed on the TSCA inventory.

CAS# 7732-18-5 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

#### CERCLA Hazardous Substances and corresponding RQs

CAS# 50-00-0: 100 lb final RQ; 45.4 kg final RQ      CAS# 67-56-1: 5000 lb final RQ;  
2270 kg final RQ      CAS# 7558-79-4: 5000 lb final RQ; 2270 kg final RQ

#### SARA Section 302 Extremely Hazardous Substances

CAS# 50-00-0: 500 lb TPQ

#### SARA Codes

CAS # 50-00-0: acute, chronic.

CAS # 67-56-1: acute, flammable.

#### Section 313

This material contains Formaldehyde (CAS# 50-00-0, 3.7%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

This material contains Methyl alcohol (CAS# 67-56-1, 1.5%), which is subject to the

reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

**Clean Air Act:**

CAS# 50-00-0 is listed as a hazardous air pollutant (HAP).  
CAS# 67-56-1 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

**Clean Water Act:**

CAS# 50-00-0 is listed as a Hazardous Substance under the CWA. CAS# 7558-79-4 is listed as a Hazardous Substance under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**

CAS# 50-00-0 is considered highly hazardous by OSHA.

**STATE**

CAS# 50-00-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 67-56-1 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 7558-79-4 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

CAS# 7558-80-7 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

CAS# 7732-18-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

**California Prop 65**

**The following statement(s) is(are) made in order to comply with the California**

**Safe Drinking Water Act:**

WARNING: This product contains Formaldehyde, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 50-00-0: 40 æg/day NSRL

**European/International Regulations**

**European Labeling in Accordance with EC Directives**

**Hazard Symbols:**

T

**Risk Phrases:**

R 45 May cause cancer.

**Safety Phrases:**

S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 36/37 Wear suitable protective clothing and gloves.

S 51 Use only in well-ventilated areas.

**WGK (Water Danger/Protection)**

CAS# 50-00-0: 2

CAS# 67-56-1: 1

CAS# 7558-79-4: 1

CAS# 7558-80-7: 1

CAS# 7732-18-5: No information available.

**Canada - DSL/NDSL**

CAS# 50-00-0 is listed on Canada's DSL List.  
CAS# 67-56-1 is listed on Canada's DSL List.  
CAS# 7558-79-4 is listed on Canada's DSL List.  
CAS# 7558-80-7 is listed on Canada's DSL List.  
CAS# 7732-18-5 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2B.

**Canadian Ingredient Disclosure List**

CAS# 50-00-0 is listed on the Canadian Ingredient Disclosure List.  
CAS# 67-56-1 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

**MSDS Creation Date:** 6/07/1999

**Revision #5 Date:** 9/16/2002

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*